WAVETEK

DM5XL, DM10XL, DM15XL
Pocket-Sized Digital Multimeters

Operator's Manual

WARNINGS AND PRECAUTIONS

PLEASE READ SECTION II WARNINGS AND PRECAUTIONS, SECTION III OPERATING INSTRUCTIONS, AND SECTION IV SPECIFICATIONS .

Exceeding the maximum limits of this instrument is DANGEROUS.

Exceeding these limits will expose you to physical injury or even death and will almost certainly damage your instrument. Even low-level voltages and currents are capable of causing serious injury or even death.

Please do not use this or any piece of test equipment without proper training. Individual functions and ranges have different overload limits. It is VERY IMPORTANT that you make yourself aware of these overload limits. Check the specifications of these overload limits. Check the specifications in SECTION IV.

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1000-0532-00C

Warranty

One Year Limited Warranty

Pocket-Sized Digital Multimeters are warranted in entirety against defects of material or workmanship which develop for any reason whatsoever, except abuse, within a period of one year following the date of purchase of the multimeter by the original purchaser. This warranty is extended by Beckman Industrial Corporation only to the original purchaser or original user of the multimeter.

In the event a defect develops during the warranty period, Beckman Industrial Corporation at their election will repair or replace the multimeter with a new or reconditioned model of equivalent quality. In order to obtain performance of any obligation of Beckman Industrial Corporation under the warranty, the original purchaser or original user must return the defective multimeter postage prepaid to:

In the event of replacement with a new or reconditioned model, the replacement unit will continue the warranty period of the original multimeter.

ANY IMPLIED WARRANTIES ARISING OUT OF THE SALE OF A DMM SERIES MULTIMETER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE STATED ONE (1) YEAR PERIOD. MANUFACTURER SHALL NOT BE LIABLE FOR LOSS OF USE OF THE MULTIMETER OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, OR ECONOMIC LOSS OR FOR ANY CLAIM OR CLAIMS FOR SUCH DAMAGE, EXPENSES OR ECONOMIC LOSS.

Some states do not allow limitations on how long implied warranties last or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

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Section I Introduction

Unpacking and Inspection

Upon removing your new Digital Multimeter (DMM) from its packing, you should have the following items:

1. Digital Multimeter
2. Test Lead Set (1 black, 1 red)
3. 9-Volt Battery (in meter)
4. Warranty Card
5. Operator's Manual
6. One Spare Fuse (installed in battery compartment)

If any of the above items are missing or are received in a damaged condition, please contact the distributor from whom you purchased the unit.

Familiarization

1. **Function/Range Switch:** Selects the Function and Range desired.
2. **COM Input Terminal:** Ground input connector.
3. **VΩ Input Terminal:** Positive input connector for voltage, resistance and logic.
4. **200mA Input Terminal:** Positive input connector for current up to 200mA.
5. **10A Input Terminal:** Positive input connector for current up to 10A.
6. **Low Battery LCD Annunciator:** Indicates battery is low and needs replacement.
7. **Safety Tester ™:** Voltage Level Detector.

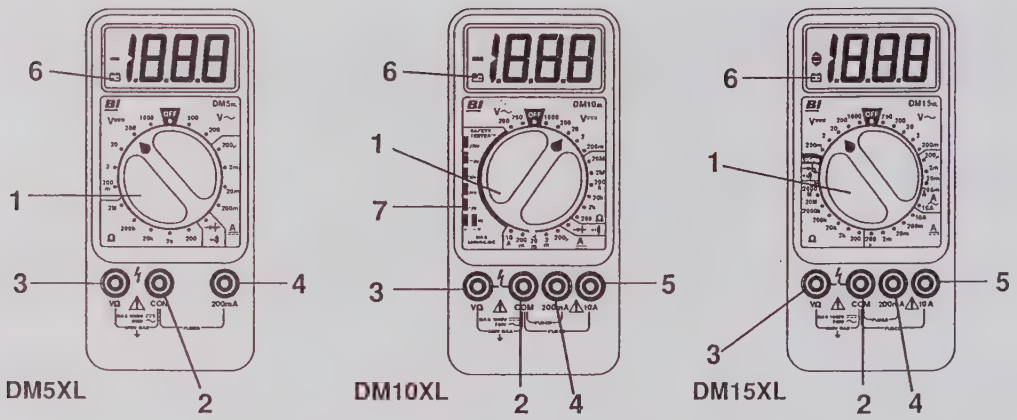

Figure 1. Models DM5XL, DM10XL, DM15XL

Section II Warnings and Precautions

Injury or death can occur even with low voltages and low currents. It is extremely important that you read these safety warnings before using your multimeter. Follow all safety practices and proper operating procedures for equipment being tested.

WARNINGS! "W"

When "W" is used in this manual it advises the user of a hazard that could result in serious injury or even death. "W" refers the user to the WARNINGS in this section, pages 5, 6, and 7; as well as in Section III, Operating Instructions and in Section V, Maintenance Procedures.

PRECAUTIONS! "P"

When "P" is used in this manual it advises the user of a hazard that could cause damage or malfunction in the instrument. "P" refers the user to the PRECAUTIONS in

this section, page 7 as well as in Section III, Operating Instructions and in Section V, Maintenance Procedures.

WARNINGS! "W"

"W"	These meters are not recommended for high voltage industrial use applications but for use with low energy circuits to 750VAC or 1000VDC, or high energy circuits to 250VAC or DC.

"W" Exercise extreme caution when:
Measuring voltage above 20 volts, measuring current greater than 10mA, measuring AC power line with inductive loads, measuring AC power line during electrical storms.

"W" Always inspect your DMM, test leads and accessories for any sign of damage or abnormality before every use. If any abnormal conditions exist (ie, broken or damaged test leads, cracked case, display not reading, etc.), do not attempt to take any measurements.

"W" Never ground yourself when taking electrical measurements. Do not touch exposed metal pipes, outlets, fixtures, etc., which might be at ground potential. Keep your body isolated from ground by using dry clothing, rubber shoes, rubber mats, or any approved insulating material.

"W" Never touch exposed wiring, connections, test probe tips, or any live circuit conductors when attempting to make measurements.

"W" Never replace the protective fuse inside the DMM with a fuse other than the specified or approved equal fuse.

"W" Do not operate this instrument in an explosive atmosphere (i.e., in the presence of flammable gases or fumes, vapor or dust.)

"W" Measuring voltage which exceeds the limits of the meter may damage the meter and expose the operator to a shock hazard. Always recognize the meter's voltage limits as stated on the front of the meter.

"W" Never apply more than 500VDC between the COM jack and earth ground.

"W" Never touch a voltage source when the test leads are plugged into a current jack.

PRECAUTIONS! "P"

"P" Calibration and repair should be performed by authorized factory or calibration personnel only.

"P" Before making any current measurements always perform a fuse check first.

"P" When testing for the presence of voltage or current, make sure the voltage or current ranges are functioning correctly. Take a reading of a known voltage or current before assuming a zero reading indicates no current or voltage.

"P"	**Range overload is indicated by a "1." or by a "-1." in the display with all other digits blanked. In this condition, the user must take immediate steps to remove the cause of the overload condition from the meter. Select the next higher range until a value is displayed. If overload condition still exists in the highest range, remove test leads from the measurement setup as it is beyond the range of the meter.**

Voltage Measurements

1. Turn off power to the device under test and discharge all capacitors.
2. Plug the black test lead into the COM jack on the DMM and connect the test lead tip to a grounded point (the reference point for measurement of voltage).

3. Set the Function/Range switch to the desired voltage type (AC or DC) and range.

Note

When the magnitude of the voltage to be measured is unknown, always start with the highest range.

4. Plug the red test lead into the V jack on the DMM and connect the test lead tip to the circuit where a voltage measurement is required. Voltage is always measured in parallel across a test point.
5. Turn on power to the circuit/device to be measured and make the voltage measurement. Reduce the range setting if set too high until a satisfactory reading is obtained. For example:

Range	Measured Value	Display	Comments
1000VDC	18.75V	19	Reduce range
200VDC	18.75V	18.8	Reduce range
20VDC	18.75V	18.75	Correct range
2VDC	18.75V	1.	Overload Cond.

6. After completing the measurement, turn off power to the circuit/device under test, discharge all capacitors and disconnect the DMM test leads.

> **Note**
>
> Use a High Voltage Probe for measurement needs >1000V.

Current Measurements

1. Turn off power to the device under test and discharge all capacitors.
2. Plug the black test lead into the COM jack on the DMM and connect the test lead tip to the node that is to be the return branch for the current to be measured.
3. Set the Function/Range switch to the highest setting to match the current jack being used for the measurement. For example, 200mA setting for 200mA jack.

4. Plug the red test lead into the 10A current jack of the DMM (The 200mA current jack for the DM5XL will only measure up to 200mA of current). If it is known that the current is less than 200mA, plug the red test lead into the 200mA input jack. Current measurements are always made with the meter in series with the test branch. The circuit must be broken and the meter put in series by placing the red test lead point to the test node for current. See Figure 2.
5. Turn on power to the circuit/device under test and make the current measurement. Reduce the setting from 200mA range if range setting is too high.
6. After completing the measurement, turn off power to the circuit/device under test, discharge all capacitors, disconnect the DMM test leads and re-connect the circuit branch.

Notes

Use a current clamp for measurement needs >10A (DM10XL and DM15XL).

Each current jack has a protective fuse installed to protect the meter from damage and the user from harm if a current larger than specified for the meter is applied at the input. If the quick-acting fuse does blow, replace with like fuse. See Section V, Fuses, for part numbers.

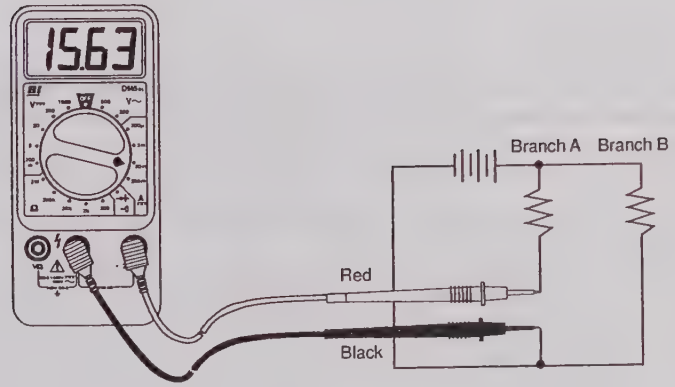

Figure 2. DMM in Series for Current Measurement

Resistance Measurements

1. Turn off any power to the resistance to be measured. Discharge any capacitors. Any voltage present during a resistance measurement will cause inaccurate readings and could damage the meter if exceeding the overload protection of 500VDC or AC.
2. Plug the black test lead into the COM jack on the DMM and connect the test lead tip to one end of the resistor.
3. Set the Function/Range switch to the resistance range that gives the most accurate measurement reading. For example:

Range	Resistor Value	Display
2MΩ	1.915kΩ	.002M
200kΩ	1.915kΩ	1.9k
20kΩ	1.915kΩ	1.92k
2kΩ	1.915kΩ	1.915k
200Ω	1.915kΩ	1. (Overload)

4. Plug the red test lead into the Ω jack on the DMM and connect the test lead tip to the other end of the resistor. A resistor is non-polarized and resistance measurements do not require attention to which test lead is placed at which end of the resistor.
5. After completing the measurement, disconnect the DMM test leads.

Open circuits will be displayed as an overload condition.

Note

Test lead resistance can interfere when measuring low resistance readings and should be subtracted from resistance measurements for accuracy. Select 200Ω resistance range and make a firm contact between the two test lead points (short them together). The display value is the test lead resistance to be subtracted.

Attention DM15XL Users

The 2000MΩ range has a fixed 10-count offset in the reading. When the test leads are shorted together in this range, the meter will display 010. This residual reading must be subtracted from the reading obtained in step 4 when this range is used. For example, when measuring 1100MΩ on the 2000MΩ range, the display will read 1110, from which the 10 residual is subtracted to obtain the actual resistance of 1100MΩ.

Diode Test

The diode test measures the forward bias of a diode junction.

1. Turn off power to the device under test and discharge all capacitors.
2. Plug the black test lead into the COM jack on the DMM and connect the test lead tip to the cathode of the diode. See Figure 3.
3. Set the Function/range switch to →|←.
4. Plug the red test lead into the V Ω jack on the DMM and connect the test lead tip to the anode of the diode. The meter's display indicates the forward voltage drop (approximately 0.7V for silicon diode or 0.4V for germanium diode). Meter will display overload condition for an open diode.
5. Reverse the test lead connections to the diode to perform a reverse bias test of the diode junction. See Figure 3. A "1" (overrange) indicates a good diode because a good diode junction in reverse bias has practically infinite resistance.
6. After completing the measurement, disconnect the DMM test leads.

Notes

Overload conditions for both reverse and forward bias tests indicate an open diode. A low voltage reading for both bias tests indicates a shorted diode.

If the diode is shunted by a resistor of 1000 ohms or less, it must be removed from the circuit before taking the measurement.

Bipolar transistor junctions may be tested in the same manner described above as emitter-base and base-collector junctions are diode junctions.

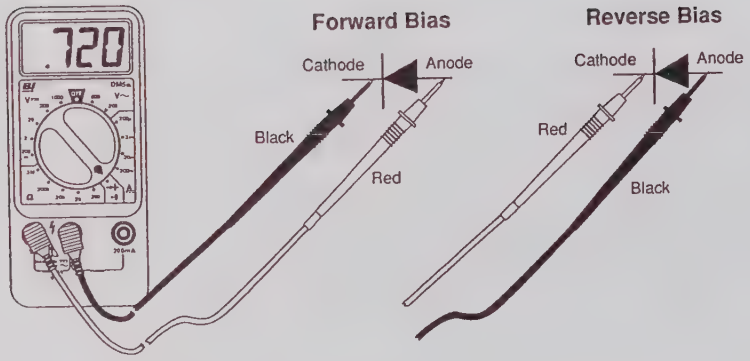

Figure 3. Diode in Forward and Reverse Bias Modes

Continuity Test

The Continuity test checks electrical continuity between two contact points.

1. Plug the black test lead into the COM jack on the DMM and connect the test lead point to one of the contact points.
2. Set the Function/Range switch to •))).
3. Plug the red test lead into the VΩ jack on the DMM and connect the test lead point to the other contact point. The internal beeper will emit a tone when resistance is less than 75Ω between the two contact points.
4. After completing the measurement, disconnect the DMM test leads.

Safety Tester™ (DM10XL)

1. This feature works when the Function/Range switch is set to any knob position within the Safety Tester range band. Set the switch to Safety Tester and note the LCD is blank. This feature does not work off the internal DMM battery. It is powered by the actual voltage that is being measured.
2. Plug the black test lead into the COM jack on the DMM. Connect the test lead tip to a ground point (reference) for the voltage to be measured.
3. Plug the red test lead in the VΩ jack on the DMM. Connect the test lead tip to the point to be measured for voltage.
4. The Safety Tester LEDs will light in sequence up to the threshold of voltage that is present. Both the yellow and red LEDs at 6V will light if the voltage is an AC (alternating current) signal. If only the red LED at 6V lights (yellow LED is off), the voltage is a plus DC (direct current) signal. Or if the yellow LED is lit but not the red LED at 6V, the voltage is a minus DC signal with respect to the ground point connected to the black test lead. See figure 4.

5. Safey Tester is a unique DMM feature that enables you to detect the presence of voltages even if the DMM battery is dead. Now, you can always determine if a voltage is present and know that caution should be exercised.

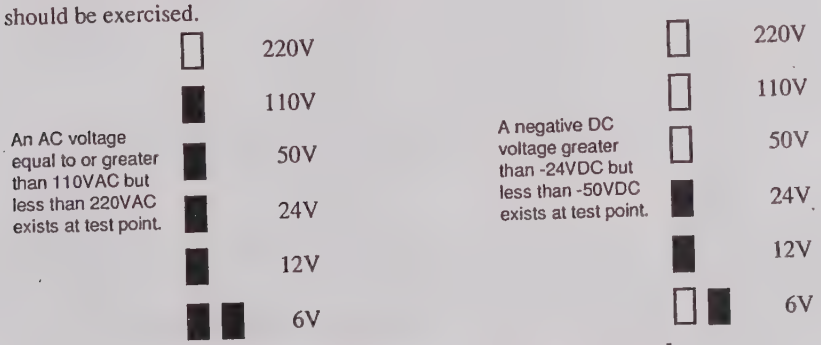

Figure 4. Safety Tester Voltage Level Examples

Logic Measurements (DM15XL)

1. Select the logic function with the Function Switch.
2. Insert the black test lead into the COM jack on the DMM and connect the test lead tip to the common bus of the logic circuitry to be measured.
3. Insert the red test lead into the VΩ jack on the DMM and connect the test lead tip to the point to be tested.
4. With a TTL logic high pulse (1), the ▲ indicator will display in the LCD.
   With a TTL logic low pulse (0), the ▼ indicator will appear in the LCD and a beeping sound will emit.

Input Lead Warning

1. The Input Lead Warning is a feature to protect the meter and you from unintentional misuse. If a DMM is connected to a voltage test point with leads set for current, very high current could result.
2. This feature warns you when a test lead is placed in a current input jack and the Function/Range switch is <u>not</u> set to current. The warning reminds you that a test lead needs to be changed from a current jack to the voltage jack.

3. When the Input Lead Warning Occurs

Test Lead Placement	Function/Range Switch	Warning Beeper
10A jack	10A	No
10A jack	Safety Tester™ (DM10XL)	No
10A jack	200µA -200mA	Yes
10A jack	Volts, Ω, →|+	Yes
200mA jack	200µA -200mA	No
200mA jack	Safety Tester™ (DM10XL)	No
200mA jack	10A	Yes
200mA jack	V, Ω, →|+	Yes

4. All current ranges are fused with fast acting ceramic fuses rated at 250 volts as an added protection.

Safety Test Leads

The test leads included with your meter have shrouded banana plugs to eliminate the possibility of shock if the plugs accidentally pull out of the meter while making a measurement. The test leads also have insulated probe tips to avoid causing shorts when making measurements in dense component areas. This insulation can be removed if desired. Make one cut down its length with a sharp utility knife and peel it off. Removal of insulation is not recommended unless it prevents making measurements in a particular application. Replacement part number for safety test leads is TL20.

Section IV Specifications

General Specifications

Display:	3 1/2 digit LCD, 1999 counts
Polarity Indication:	Automatic, positive implied, negative indicated
Zero Adjustment:	Automatic
Overrange Indication:	(1.) or (-1.) is displayed
Low Battery Indication:	is displayed when the battery voltage drops below accurate operating level. Change battery when low battery is indicated.
Display Update Rate:	3 per second, nominal
Operating Temperature:	0°C to 50°C, 0 to 70% Relative Humidity
Storage Temperature:	-20°C to 60°C, 0 to 80% RH with battery removed from meter
Power:	Standard 9-volt transistor battery, NEDA 1604, JIS 006P, IEC 6F22

Battery Life (Typical):	300 hours alkaline, 200 hours carbon-zinc
Dimensions (H x W x D):	6.1 x 2.8 x 1.3 inches, (15.5 x 7.2 x 3.2 cm)
Weight (including battery):	8 ounces (210 grams)
Accessories:	One pair test leads, one spare fuse installed in battery compartment, battery, and Operator's Manual

Electrical Specifications

Stated accuracy at 23°C ± 5°C, less than 75% RH

DC Volts

	DM5XL	DM10XL	DM15XL
Accuracy: All Ranges	±(0.8% Rdg + 1 digit)	±(0.7%Rdg + 1 digit)	±(0.5% Rdg + 1 digit)
Resolution: 200mV Range	100µV	100µV	100µV
Input Impedance	1MΩ	10MΩ	10MΩ
OL Protection: 200mV Range	350VAC RMS/500VDC for 15 seconds		
All other Ranges	750VAC RMS/1000VDC		

AC Volts (50-500Hz)

	DM5XL	DM10XL	DM15XL
Accuracy: 200mV, 2V, 20V,	–	–	±(1% Rdg + 4 digit)
200V Range	±(1.2%Rdg + 10 digit)	±(1%Rdg + 4 digit)	
500V/750V Range	±(1.2%Rdg + 10 digit)	±(1.5%Rdg + 4 digit)	
Input Impedance	450kΩ	4.5MΩ	10MΩ
OL Protection: All Ranges	500VDC or AC RMS	750VAC RMS/1000VDC	
Except: 200mV	–	–	350VAC/500VDC - 15 sec.

DC Current

	DM5XL	DM10XL	DM15XL
Accuracy: 200µA to			
200mA Range	±(1.2%Rdg + 1 digit)	±(1%Rdg + 1 digit)	
10A Range	–	±(2%Rdg + 3 digit)	
Resolution: 200µA Range	100nA		
OL Protection: 200mA Jack	0.5A/250V fast blow ceramic fuse		
10A Jack	–	10A/250V fast blow ceramic fuse	

AC Current (50-500Hz)

	DM5XL	DM10XL	DM15XL
Accuracy: 200µA to			±(1.5%Rdg + 4 digit)
200mA Ranges	–	–	±(2.5% + 4 digit)
10A Range	–	–	100nA
Resolution: 200µA Range	–	–	0.5A/250V fast blow ceramic fuse
OL Protection: 200mA Jack	–	–	10A/250V fast blow ceramic fuse
10A Jack	–	–	

Resistance

	DM5XL	DM10XL	DM15XL
Accuracy: 200Ω Range	±(1%Rdg + 3 digit)		
2k to 2MΩ Range	±(1.2%Rdg + 2 digit)	±(1% Rdg + 1 digit)	
20MΩ Range	–	±(3%Rdg + 1 digit)	
2000MΩ Range	–	–	±(5%Rdg -10digit) + 10 digit
Resolution: 200Ω Range	100mΩ		
OL Protection: All Ranges	500VDC or AC		

Diode Test

	DM5XL	DM10XL	DM15XL
Test Current/Voltage	1mA (approx.) / 3.2VDC		
Display	Forward Junction Voltage		

Continuity

	DM5XL	DM10XL	DM15XL
Audible Indication	Less than 75		
OL Protection	500VDC or AC		

Safety Tester™ (DM10XL only)

Overload Protection: 350VAC RMS for one hour, 350VDC for 30 seconds.

Logic Test (DM15XL only)

Logic Type	TTL
Input Impedance	120k ±10k
Logic Thresholds	
Logic 1	2.8 ±0.8V
Logic 0	0.8 ±0.5V
Frequency Response	20MHz
Pulse Width Detectable	25nS minimum
OL Protection	500VAC RMS/DC

Section V Maintenance Procedures

Troubleshooting

If there appears to be a malfunction during the operation of the meter, the following steps should be performed in order to isolate the cause of the problem:

1. Check the battery.
2. Review the operating instructions for possible mistakes in operating procedure.
3. Inspect and test the Test Probes for a broken or intermittent connection.
4. Inspect and test the fuse. If it is necessary to replace the fuse, be sure to install one with the proper current and voltage values, see Fuse Replacement.

Fuse Replacement

1. After disconnecting test leads and turning off the multimeter, remove the rear case by unscrewing the two screws that secure it to the front case. Gently pry the rear case away from the front case to release the four plastic hold down catch-tabs also securing the meter together. See figure 5.

2a. **mA Input Jack Fuse:** Carefully remove the blown fuse (5 x 20mm) from the fuse holder. Replace with a 0.5A/250V quick acting ceramic fuse (one spare fuse is located on the right side of the battery compartment). Beckman Industrial replacement fuse part number is FP 225 (a pack of four fuses).

2b. **10A Input Jack Fuse:** Carefully remove the 10A/250V fuse (6.3 x 25.4mm) from the 10 Ampere fuse holder. Replace with a new 10A/250V quick acting ceramic fuse. Beckman Industrial replacement fuse part number is FP325 (a pack of four fuses).

"W"	**Use only an equivalent fuse to the one specified. Use of an incorrect fuse could result in serious injury or even death.**

3. Align rear case over the front case and snap back together. Replace the two screws.

"W"	**To prevent electrical shock hazard, turn off the multimeter and any device or circuit under test and disconnect the test leads before removing the rear cover.**

Battery Replacement

1. After disconnecting test leads and turning off the multimeter, remove the rear case by unscrewing the two screws that secure it to the front case. Gently pry the rear case away from the front case to release the four plastic hold down catch-tabs also securing the meter together. See figure 5.
2. Remove battery and replace with a new NEDA type 1604 or equivalent 9-volt alkaline battery. Wind the excess lead length once around the battery clip and install the battery.
3. Align rear case over the front case and snap back together. Replace the two screws.

"P"	**Failure to turn off the multimeter before installing the battery could result in damage to the instrument and to the battery if the battery is connected incorrectly to the multimeter.**

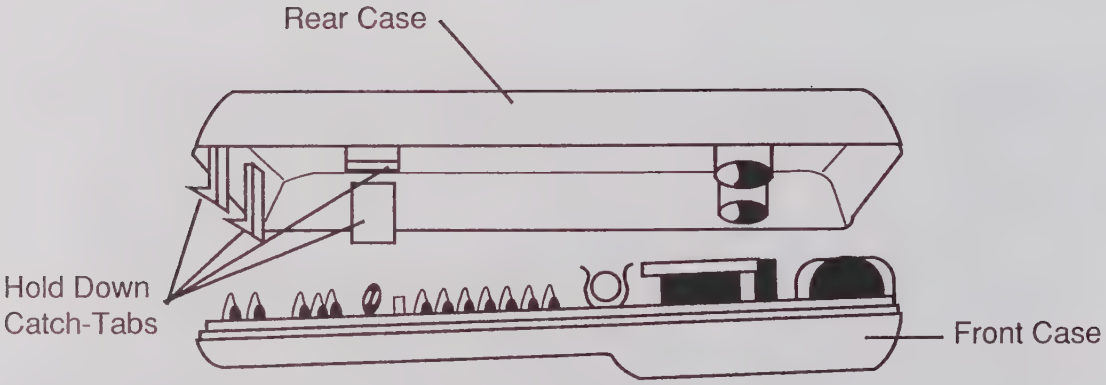

Figure 5. Chassis Assembly

Cleaning the Meter

Use only mild detergent and warm water to clean the meter. Do not use aromatic hydrocarbons or chlorinated solvents.

Calibration Procedure

The procedure should be performed at an ambient temperature of 25°C ± 2°C, and at a relative humidity of less than 80%. Allow the instrument to stabilize at this temperature for a minimum of 30 minutes.

"P"	**The following procedure should be performed by trained calibration personnel only.**

1. Remove the back case screws, and carefully pry up the back case. See figure 5.
2. Set the Function/Range switch to the VDC "200mV" position.
3. Set the output of the DC calibrator for 190.0mV ±0.02% and connect it to the "VΩ" and "COM" input terminals.

4. Adjust VR1 until the display reads 190.0V ±1 digit. (See Figure 6 for VR1 location.)
5. Carefully inspect the other DCV ranges. Your readings should meet the DCV accuracy specifications.
6. There is no adjustment for ACV.
7. Carefully inspect the ACV ranges. Your readings should meet the ACV accuracy specifications of the ACV calibration source.
8. Carefully inspect the DCA ranges. Your readings should meet the DCA accuracy specifications.
9. Turn off calibrator and disconnect from the DMM.
10. Reassemble the back case and secure with two screws.
11. If ACV or DCA ranges are out of specification after the DCV has been calibrated, there is a malfunction within the meter. See Section VI, Service Information for meter return information.

Figure 6. VR1 Location for DM5XL, DM10XL, and DM15XL.

Section VI Service Information

In the United States and Canada, the limited warranty period is one year. For further warranty information, or for warranty information in Europe, please contact the following:

U.S. and CANADA

Wavetek Corporation
Attn: Instrument Repair
9045 Balboa Avenue, Suite A, San Diego, California 92123

EUROPE

Warranty Repair

Any DMM within its warranty period and claimed to be defective should be returned to Wavetek Corporation. In Europe, please contact the above address for warranty repair information.

Non-Warranty Repair

Any out-of-warranty WAVETEK Service Center or by **Wavetek** DMM that is defective, but repairable, may be repaired by an authorized Corp. The repaired unit carries a six (6) month warranty. Inside the U.S. or in Canada, please contact Beckman Industrial or an authorized Service Center for the current out-of-warranty repair rates. In Europe, contact the previously listed address for out-of-warranty repair information.

Shipping Instructions

DMMs returned for repair or for calibration should be accompanied by the following information or items: company name, customer's name, address, telephone number, proof of purchase (warranty repairs), a brief description of the problem or the service requested, and the appropriate service charge. Please include the test leads with the meter.

Service charges should be remitted in the form of a check, a money order, or a purchase order made payable to WAVETEK The DMM should be shipped with transportation charges prepaid to the following address:

The DMM will be returned with the transportation charges paid by :

Optional Accessories Available:		DM5XL	DM10XL	DM15XL
VC20	Vinyl Carrying Case	√	√	√
DL243B	Deluxe Test Leads	√	√	√
TL 20	Replacement Safety Test Leads	√	√	√
CT231	AC Current Clamp	–	–	√
CT233	AC & DC Current Clamp	–	√	√
HV231-10	HV Probe	–	√	√
RF241	RF Probe	√	√	√
TC253	Temperature Converter	√	√	√
TP254	General Purpose Temperature Probe	√	√	√

U.S.A.

In Europe

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